

BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED



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Section-IV

TECHNICAL SPECIFICATION

**Providing Communication Solution and Technology for
SCADA operations of SPB remote devices pertaining to
South zone of BMAZ**

Issued By

General Manager (DAS)

Corporate office, BESCOM
BESCOM Integrated Control Center-1,
17th cross, 24th Main,
Sector-2, HSR layout
Bangalore-560102

E-mail ID: gmdas@bescom.co.in

Mobile No.:9448279010

Office No.:080-22586356

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1. Introduction

BESCOM has implemented Distribution Automation System (DAS) for monitoring, supervisory control and operation of 11kV distribution network in Bengaluru city to improve power supply availability to consumers, reduce interruption duration and manage power supply. DAS has facilitated rapid restoration of power supply to consumers who are not connected to a fault and early rectification of fault thus reducing interruption duration and also manage power supply.

To facilitate DAS operations, 3130 SCADA 11kVswitch gears (RMUs: 1590 Nos, LRC / LBS: 1540 Nos.) were installed. The status and analog details of these switch gears are transmitted to DAS Control Centers located in HSR Layout and Rajajinagar through BESCOM's own RF based licensed communication system.

The objective of the project is to develop a Self-sustained independent communication network for RTU's communication with Distribution Automation system Control Center's located at HSR Layout and Rajaji Nagar. This will enable BESCOM for continuous monitoring of power system real time parameters of 11KV SCADA switchgear from DAS control centre. Communication infrastructure proposed is pertaining to the new SCADA enabled switchgears (Single Panel Breakers) being added under Upgradation of DAS project.

This Technical Specification concerns the Communication System to be designed, supplied, installed, commissioned and integrated as part of Communication System expansion for DAS operations in Bangalore City by establishing communication to the Single Panel Breakers.

2. Scope of Work

The scope of work includes design, supply, installation, commissioning and integration of all hardware and software that shall establish a properly functioning Communications System providing reliable, secure, and efficient data communications in support of the DAS operations. In this respect, the intent is to create an integrated communications network that, together with the DAS, shall ensure the lowest achievable latencies and highest speed of data throughput given the constraints of the technology and protocols used for the delivery of data.

The Contractor shall design, supply, install, commission and integrate the automated points with DAS Communication Facility Phase-wise. The list of sites to be covered in each Phase will be provided during the design phase of implementation. Brief scope includes the following.

1. BESCOM intend to integrate all field Remote Terminal Unit with DAS system which are installed inside 11kV switchgears (Single Panel Breaker). For that bidder have to establish complete communication network for integration of RTU's with control centres.
2. Design, Supply, Installation, Testing and Commissioning of communication equipment at Single Panel Breaker (SPB) site and all required accessories or equipment to establish communication with both Control centres.

3. Providing M2M (13 digit) MPLS VPN SIMs for operation with minimum 1GB per month.
4. Link demonstration of communication system.
5. Operation and Maintenance of system.
6. Communication logs to be made available.
7. System should be monitored centrally from control centres
8. Remote equipment data to be synchronised between the NMS (replication process) in control centres at real time in coordination with other contractors.
9. Antenna and cable for remote end communication to be provided and secured outside of SPB Panel. High gain antenna to be provided in Low Signal strength area.
10. Appropriate alternate communication mode to be established wherever SIM based solution is not working, in order to maintain the availability of the RTU for control centre.
11. Provision of any other hardware or software to meet the intent of the communication system.

3. Project Support Activities

To meet the basic communication requirements, the Contractor shall perform all necessary project support activities such as:

1. Project management to include Survey, design, planning, scheduling, supervising, and coordinating work, preparing progress reports, and attending meetings, etc. Coordination shall include cooperation with BESCO employees to fully integrate to the existing network.
2. System Factory testing, Installation, integration and Commissioning activities.
3. Training courses for Employer personnel
4. All required documentation, e.g., functional design documents, test procedures, test reports, user manuals, Training documents etc.
5. After-sales warranty and support services.

4. Project Responsibilities

The Employer and Contractor will take responsibility for various Communication System tasks. Some of the responsibilities are described below. Otherwise, specific responsibilities concerning the Contractor in particular are described elsewhere in these Technical Specifications.

4.1 Contractor Responsibilities

The Contractor shall be responsible for designing, supplying, installing, commissioning and integrating the required communication equipment in good working order and fit for its intended purpose.

1. Detailed Survey and design of the communication network.
2. Providing and configuring remote end device with proper signal strength for DAS operations.
3. Configuration and integration of all field devices to central device.

4. Integration with existing communication network and data routing in coordination with other contractors.
5. Providing training to BESCO personnel regarding the communication system.
6. Any defective/Non-Communicating/Burnt equipment to be picked up by the contractor on its own cost. Repairing allowed for minor defects but for major component failure, replacement with new equipment to be done within Warranty Period.
7. Deploying Engineer during implementation period to ensure the seamless execution and field troubleshoot if any.
8. Its supplier's responsibility to communicate with Network service provider on behalf of BESCO to ensure seamless communication and troubleshooting if any.
9. All interactions with other agencies and third parties like the basic service provider during the currency of the contract, which may be required for the provisioning of services as per contract.
10. Cooperation of different contractors as they work with the Employer in a combined effort to attain the objectives of the project. Commissioning in particular requires contractors to work in full cooperation for NMS configuration, remote end equipment configuration with SPB RTU.
11. Coordination with North Zone Communication equipment contractor for NMS configuration and data routing.
12. Demonstration of the bandwidth availability to the BESCO as and when required.
13. Telecom Provider should have ISO 27001 certification
14. Maintaining link availability as per SLA requirement

4.2 Employer Responsibilities

Employer responsibilities in support of the Communications System scope of work will include:

1. Provision of control centre, service centre, substation, and RTU location details.
2. Provision of a 230 Vac power source at control centres
3. Ensuring the site availability along with 230V AC and 24 Vdc sources of power.
4. Provision of drawings corresponding to existing network.
5. Review and approval of design drawings, FAT / SAT procedure and Training documents provided by the Contractor.
6. Witnessing during FAT & SAT.
7. Approval of Contractor-provided work plans for installing the communications equipment.
8. Coordination and inspection of the Contractor's field work.
9. Participation in Contractor-provided training courses

5. Applicable Standards

The Employer requires that all work manufactured or furnished under this specification shall comply with the latest applicable IS / IEC standards and its amendments. Exceptions shall be documented and submitted for Employer approval.

Equipment confirming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above is also acceptable. In case bidders who wish to offer material confirming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in the relevant schedule.

Equipment shall comply with these following IS / IEC standards and its latest amendments.

1	Impulse voltage test	IEC-61000-4-5(95-03)
2	Insulation resistance test	IS-13779:1999
3	Electrostatic Discharge (ESD)	IEC-61000-4-2 (1995-02)
4	Electromagnetic radiated HF susceptibility	IEC-61000-4-3 (1995-02)
5	Fast transient Burst test	IEC-61000-4-4 (1995-02)
6	Surge Immunity test	IEC61000-4-6

6. Communication System Specifications

The following specifications present the requirements that apply to all communication equipment to be provided by the Contractor except as otherwise noted.

6.1 General Requirements

All communications equipment shall be designed, fabricated, assembled, finished, and documented with workmanship of the highest production quality and shall conform to all applicable quality control standards of the original manufacturer and the Contractor. All components shall be of current production from reliable component manufacturers.

To satisfy these Technical Specifications, manufacturer standard designs shall be used to the fullest extent possible. Relevant type test certificates and results shall be submitted with the bid. The certification shall not be older than five years prior to the Effective Date of Contract.

All materials comprising the communication equipment shall be new and unused and consist of the best industrial grade. Materials promoting the growth of fungus or susceptibility to corrosion and heat degradation shall not be used. In addition, steps shall be taken to provide rodent proof installations.

To facilitate expansion and maintenance, modularity shall be employed in the design of the equipment. All major subassemblies shall carry permanent labels providing a cross-reference to the Contractor's documentation.

All features of the proposed equipment, as described in the Contractor's bid and in the bid's reference materials, shall be fully supported by the equipment actually delivered.

6.1.2 Maintainability

The Employer prefers communication equipment designs that do not require periodic preventive maintenance and inspections. If periodic maintenance is required, it shall be possible to perform all such work in the field without dismounting the equipment and without requiring that the associated medium or high voltage circuit be de-energised.

6.2 Service Conditions

Unless otherwise specified, the communication equipment including any supporting equipment shall be suitable for rated operation under the following service conditions:

1. Operation at elevations of at least 1,000 meters above sea level.
2. Ambient conditions dependent on where the device is installed (indoors or outdoors) as stated in the following sub-clauses.

Suitably accredited test laboratories that are independent of the bidder and equipment manufacturer shall have performed the type tests. Certified copies of the type test certificates and test results shall be included as part of the bidder's proposal.

6.2.1 Indoor Equipment

Though indoor communication equipment installed in control centres may operate in air-conditioned rooms, they shall be capable of operating in rooms (such as Service Centre rooms) that may not be air-conditioned or where the air-conditioning has failed. Consequently, this equipment shall be suitable for rated operation under the following controlled and uncontrolled service conditions:

1. Ambient air temperatures between 10 and 60 °C.
2. Relative humidity averaging up to 95% (non-condensing).

6.2.2 Outdoor Equipment

All outdoor equipment provided by the Contractor, to be installed in outdoor enclosures shall be suitable for continuous operation in India's tropical monsoon climate, which includes exposure to severe frequently occurring thunderstorms. This equipment shall also be suitable for conditions in which they may be exposed to heavy industrial pollution and high levels of airborne dust.

Equipment shall be suitable for rated operation under service conditions such as:

1. Ambient air temperatures of at least 60 °C.
2. Relative humidity of at least 95% (non-condensing).

6.3 Electric Surge Protection

All external connections for the communication equipment including communication ports, communication lines, and power supply inputs and outputs shall be designed to withstand the fast transient and surge voltage. The communications equipment shall be capable of withstanding the tests without damage, loss of internally stored data and parameters.

6.4 Power Supplies and Enclosures

Power supply and enclosure requirements depend on the location of the communication equipment. This is summarised as follows:

Table 1: Power Supply and Enclosure Requirements

Location of Communication Equipment	Enclosures	Power Supply Source	
		DC Power	AC Power
RTU Site	Provided by Employer	24Vdc Source Provided by Employer	230 Vac Provided by Employer
Control Centre	Provided by Employer	48Vdc Source Provided by Contractor	230 Vac Provided by Employer

Other general requirements are listed as follows:

1. The manufacturer of Remote End device (SD-WAN / Modem) supplied under this contract shall be certified as an ISO 9001 approved facility. A certificate of ISO 9001 certification must be included with the bid documents.
2. Integration with Software tool provided by North Zone network provider to allow the remote equipment maintenance and diagnostic data (preferably through SNMP) to be accessed and displayed in graphical form.
3. Hardware and/or software facilities allowing the communication system maintenance and diagnostic data to be accessed via DAS as well as the required field test equipment, shall be included. This feature of the communication system shall also allow the maintenance and diagnostic data to be viewed on a properly authorised and secure basis from workstations to be established by North Zone Contractor.

7. Technical Specifications

7.1 Remote End Equipment

- The Remote end equipment provided by the contractor will be used for communication between RTU installed at SPB and Control Centres. It shall be required to operate satisfactorily and continuously under the following tropical conditions defined above.
- It shall support point to point and point to multipoint communication with both master and slave mode operations. It shall support dual SIM card with active standby capability that can work with different service providers. Equipment mounting shall be such that SIM card tray can be easily accessible without removing it.
- Equipment shall comply with IP55 degree of protection.
- Remote end communication equipment shall also support network changeover on dual SIM operations with following combinations:
 1. Auto-changeover based on Network availability
 2. Auto-changeover based on predefined priority.

3. Remote Network Changeover capabilities.

- The supplier shall provide terminal software/interface and adequate port for configuration and diagnosis.
- It shall have auto reconnection facility in case of disconnection to server & all disconnection shall be reported to server. It shall support hardware & software WDT (Watchdog Timer). It shall have facility to auto reboot over disconnection with remote server up to certain defined time.
- It shall support following cellular standards: 3G & 4G cellular network GSM/GPRS/EDGE/UMTS/HSPA+/LTE FDD/LTE TDD.
- It shall support following cellular band: LTE FDD 2600/2100/1800/900/800MHz, UMTS/HSPA+: five-band 800/850/900/1900/2100 MHz, GSM/GPRS/EDGE: quad-band 850/900/1800/1900 MHz.
- It shall support all cellular networks available and approved by Telecom Regulatory Authority of India (TRAI). It shall have 2 No. of Ethernet LAN with 10/100 Mbps RJ45 port. It shall support MPLS, MVPN, IPSec and Open VPN Network connectivity for establishing remote connection between Control centre and RTU. It shall be able to create four (04) VPN tunnels simultaneously with Four (04) different SCADA master servers.
- Remote end equipment shall be powered up with 24V DC +/- 5% and support both Dynamic IP SIM and Static IP SIM and configurable through Local as well as remote server via Web UI or other configuration software. It shall support NAT table routing and TCP, UDP, ICMP, SNMP, NAT, DMZ protocols.
- It shall be designed and constructed in such a way to avoid introducing any danger in use and under normal conditions so as to ensure specially
 1. Personnel safety against electric shock.
 2. Personnel safety against effects of excessive temperature.
 3. Protection against spread of fire.
 4. Protection against penetration of solid objects, dust and water
- It shall be capable to withstand surges and voltage spikes by providing necessary isolation and / or suppression system built in the system. External surge protection device also to be provided.
- Antenna and cable for remote end communication to be provided and secured outside of SPB Panel. High gain antenna to be provided in Low Signal strength area. Antenna mounting arrangement at remote site will be finalized during design stage. Necessary material required is included in the scope of work under remote end equipment and accessories.
- As per TRAI guidelines, 13 digit SIM cards to be used for M2M operation. It is mandatory to support all functionality with 13digit SIM cards and 10 digit SIM cards without any firmware or setting modification. It shall have facility to send SMS to configured mobile (min 2 nos) for selected event.
- All other communications should be blocked other than data exchange from remote to Control centre.
- Equipment should have Mandatory Testing and Certification of Telecommunication Equipment (MTCTE) issued by Ministry of Telecommunication

- For determining health of the device an LED shall be provided which will depict the current functioning status (power on / transmitting data).

7.1.1 Diagnostic Provisions

BESCOM shall be able to remotely monitor diagnostic capabilities from control centre. As a minimum requirement the following remote diagnostic points to be made available at control centre.

1. Signal Strength Level
2. Data connection state
3. Device uptime
4. LAN port Status
5. IP Address

7.1.2 Protocols

DNP3.0 / IP protocol is used for SCADA communication from RTU to Control centre.

8. Training

The Contractor shall prepare and deliver a comprehensive training program on the operation and maintenance of the Complete Communication System.

The training program shall teach Employer staff the skills needed for database, display, and report construction including verification and maintenance. Software training shall equip Employer staff with the skills required for System maintenance and expansion and for the preparation and integration of new functions. Hardware training shall qualify Employer staff to perform routine preventive maintenance and perform diagnostic tests on the processors, network equipment, and other peripheral equipment.

Table: Course Attendants

Course Name	Attendees per cycle	Location	No of cycle	Estimated Working Days
Communications Overview & Equipment Courses	10	Employer Site	2	1

9. Testing and Inspection

9.1 Factory Inspections and Tests

Factory inspections and tests shall be performed for the system to ensure compliance with the Technical Specifications. Responsibility for conducting the factory tests shall rest with the Contractor. The Employer (QS&S officials and DAS officials of BESCOM) will perform the communications equipment inspections and witness the factory testing.

The Contractor shall cover Employer representative air travel, ground transportation, and accommodation (including meals) during the required inspection and test witnessing trips. For bidding purposes, up to three representatives shall be taken into account. The Contractor shall take all necessary steps to address and resolve any concerns that the Employer representatives may raise as a result of these activities in a timely fashion. This may result in further inspections and tests until the representatives are fully satisfied that the inspections and tests have been completed successfully. The costs of such additional inspections and tests shall be borne by the Contractor.

The communications equipment shall pass the manufacturer's standard routine tests in accordance with the referenced standards. Certified copies of all routine test results shall be provided as part of the FAT documentation.

No communications equipment shall be shipped until the Employer is satisfied that the approved Factory Acceptance Test (FAT), as based on the inspections, type tests, routine tests, and performance tests below, has been completed successfully. In particular, all variances resulting from FAT shall have been resolved to the Employer's satisfaction prior to shipment.

9.2 Shipment

The communications equipment shall be sufficiently sturdy to withstand handling during shipment, installation, and start-up without damage. The configuration for shipment shall adequately protect the equipment from scraping, banging, or any other damage. The Contractor shall assume responsibility for correction of all such damage prior to final acceptance.

9.3 Link Establishment / Commissioning Tests

As soon as the installation has been completed and put in a tight and clean condition as specified in the Technical Specifications and establishment of link from Control Centre CS equipment, the Contractor shall so notify BESCO in writing. All sites to be tested from NMS for proper functioning. This will constitute link establishment / commissioning of the links. After verification of the links as per the approved procedure Link establishment certificate to be issued by BESCO.

Any equipment offline because of power supply issue at SPB end, for link establishment temporary portable batteries to be used by the contractor.

9.4 Availability Test

The Communications System shall be subjected to a One Hundred (100) hours system availability test after link establishment from NMS before being put into commercial service. The purpose of this test is to validate the required in-service availability of the system and its component parts has been met.

Any equipment offline because of power supply issue at SPB end to be excluded from the test.

9.5 Integrated System Test

Sites to be tested for verification of transmission of data from RTUs to control centre. Sample one DI/DO and one AI/AO to be verified. Any issue in the SPB and RTU will not cause failure of the communication test.

10. Warranty and AMC

10.1 Warranty details

The Contractor shall provide Communications System warranty services for a period of two (2) years following Link establishment certificate. All systems and subsystems comprising the Communications System shall be maintained in operational order by the Contractor during this period as per the SLA. Contractor to keep enough spare material to maintain the system healthiness.

10.2 Annual Maintenance Contract

The Contractor shall provide Communications System warranty services for a period of three (3) years following completion of warranty period. All systems and subsystems comprising the Communications System shall be maintained in operational order by the Contractor during this period.

Minor repairs to be rectified by the contractor. Incase of major failure like equipment faulty / Non-repairable equipment will be to BESCOM account. Contractor to facilitate the service upon receipt of new equipment.

10.3 Service Level Agreement

Sl No	Fault Correction	Response time	Contact Method	Restoration time	On site
1	Remote Site equipment Issue	Two days	e-mail	According to mutually agreed schedule	If needed, as mutually agreed
2	Remote Site equipment reporting issue to NMS	Two days	e-mail	According to mutually agreed schedule	If needed, as mutually agreed
3	SIM related issues	Two days	e-mail	According to mutually agreed schedule	If needed, as mutually agreed
4	Any other issue	Same day	e-mail	According to mutually agreed schedule	If needed, as mutually agreed

* Monday to Saturday

10.4 SPARES:

Contractor to maintain spares required for the smooth functioning of the system. BESCO may be required to provide any or all of the materials to be kept as spares, notifications, and information pertaining to spare parts manufactured or distributed by the Contractor:

- (a) such spare parts as BESCO may elect to purchase from the Contractor, providing that this election shall not relieve the Contractor of any warranty obligations under the Contract; and
- (b) In the event of termination of production of the spare parts:
 - (i) advance notification to BESCO of the pending termination, in sufficient time to permit the BESCO to procure needed requirements; and
 - (ii) following such termination, furnishing at no cost to BESCO, the blueprints, drawings and specifications of the spare parts, if requested.

The Contractor shall carry sufficient inventories to assure ex-stock supply of spares required for the project. List of Spare material to be given in the format as per Annexure G: Bid Form. Other spare parts and components shall be supplied as promptly as possible but in any case within 1 month of placement of order.